

## Claims

We Claim:

- 1) A composition of matter comprising an aerogel having a monolayer coating.
- 2) The composition of matter of claim 1, wherein said aerogel is a ceramic oxide.
- 5 3) The composition of matter of claim 2, wherein said ceramic oxide is selected from the group consisting of silica, alumina, aluminosilicate, and combinations thereof.
- 4) The composition of matter of claim 1, wherein said monolayer coating is formed of self-limiting monomers.
- 10 5) The composition of matter of claim 4, wherein said self-limiting monomers are selected from the group consisting of alkyl silanes, chlorosilanes, boranes, chloroboranes, germanes, and combinations thereof.
- 6) The composition of matter of claim 1 wherein said aerogel having said monolayer coating has pore sizes of between 150 Å and 250 Å and  
15 bottlenecks of between 110 Å and 150 Å.
- 7) A composition of matter comprising a ceramic oxide aerogel having a monolayer coating consisting essentially of a self-limiting monomer.
- 8) The composition of matter of claim 7, wherein said ceramic oxide is selected from the group consisting of silica, alumina, aluminosilicate, and  
20 combinations thereof.
- 9) The composition of matter of claim 7, wherein said self-limiting monomer is selected from the group consisting of alkyl silanes, chlorosilanes, boranes, chloroboranes, germanes, and combinations thereof.
- 10) The composition of matter of claim 7, wherein said wherein said ceramic  
25 oxide aerogel having said monolayer coating has pore sizes of between 150 Å and 250 Å and bottlenecks of between 110 Å and 150 Å.
- 11) A method for forming an aerogel having a monolayer coating comprising the steps of:
  - a. providing an aerogel and a monolayer forming precursor in a supercritical  
30 fluid,

b. reacting said aerogel and said monolayer forming precursor in said supercritical fluid to form a covalent bond between said aerogel and said monolayer forming precursor.

12) The method of claim 11, wherein said aerogel is provided as a ceramic oxide.

5 13) The method of claim 11, wherein said ceramic oxide is provided as selected from the group consisting of silica, alumina, aluminosilicate, and combinations thereof.

14) The method of claim 11, wherein said monolayer forming precursors are provided as self-limiting monomers.

10 15) The method of claim 14, wherein said self-limiting monomers are provided as selected from the group consisting of alkyl silanes, chlorosilanes, boranes, chloroboranes, germanes, and combinations thereof.

16) A method for forming an aerogel having a monolayer coating comprising the steps of:

15 a. providing an aerogel, a surface preparation agent, and a monolayer forming precursor in a supercritical fluid.

b. reacting said aerogel, said surface preparation agent and said monolayer forming precursor in said supercritical fluid to form a covalent bond between said aerogel and said monolayer forming precursor.

20 17) The method of claim 16, wherein said aerogel is provided as a ceramic oxide.

18) The method of claim 16, wherein said ceramic oxide is provided as selected from the group consisting of silica, alumina, aluminosilicate, and combinations thereof.

25 19) The method of claim 16, wherein said monolayer forming precursor is provided as self-limiting monomers.

20) The method of claim 19, wherein said self-limiting monomers are provided as selected from the group consisting of alkyl silanes, chlorosilanes, boranes, chloroboranes, germanes, and combinations thereof.

30 21) A method for forming an aerogel having a monolayer coating comprising the steps of:

a. hydroetching an aerogel to provide a hydroetched aerogel.

- b. providing said hydroetched aerogel with a monolayer forming precursor in a supercritical fluid,
- c. reacting said hydroetched aerogel and said monolayer forming precursor in said supercritical fluid to form a covalent bond between said hydroetched aerogel and said monolayer forming precursor.

22) The method of claim 21, wherein said aerogel is provided as a ceramic oxide.

23) The method of claim 21, wherein said ceramic oxide is provided as selected from the group consisting of silica, alumina, aluminosilicate, and combinations thereof.

24) The method of claim 21, wherein said monolayer forming precursor is provided as self-limiting monomers.

25) The method of claim 24, wherein said self-limiting monomers are provided as selected from the group consisting of alkyl silanes, chlorosilanes, boranes, chloroboranes, germanes, and combinations thereof.